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Characterization of thick and thin film SiCN for pressure sensing at high temperatures

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Abstract

Pressure measurement in high temperature environments is important in many applications to provide valuable information for performance studies. Information on pressure patterns is highly desirable for improving performance, condition monitoring and accurate prediction of the remaining life of systems that operate in extremely high temperature environments, such as gas turbine engines. A number of technologies have been recently investigated, however these technologies target specific applications and they are limited by the maximum operating temperature. Thick and thin films of SiCN can withstand high temperatures. SiCN is a polymer-derived ceramic with liquid phase polymer as its starting material. This provides the advantage that it can be molded to any shape. CERASET™ also yields itself for photolithography, with the addition of photo initiator 2, 2-Dimethoxy-2-phenyl-acetophenone (DMPA), thereby enabling photolithographical patterning of the pre-ceramic polymer using UV lithography. SiCN fabrication includes thermosetting, crosslinking and pyrolysis. The technology is still under investigation for stability and improved performance. This work presents the preparation of SiCN films to be used as the body of a sensor for pressure measurements in high temperature environments. The sensor employs the phenomenon of drag effect. The pressure sensor consists of a slender sensitive element and a thick blocking element. The dimensions and thickness of the films depend on the intended application of the sensors. Fabrication methods of SiCN ceramics both as thin (about 40-60 μm) and thick (about 2-3 mm) films for high temperature applications are discussed. In addition, the influence of thermosetting and annealing processes on mechanical properties is investigated.

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Keywords

Dynamic pressure sensing at high temperatures, Polymer derived ceramic, SiCN